Lead poisoning in bald eagles in British Columbia

Ken M. Langelier, Claus E. Andress, T. Keith Grey, Chris Wooldridge, Ron J. Lewis, Rosanna Marchetti

Lead poisoning in bald eagles has not been reported previously in British Columbia but has been diagnosed as a cause of death in this species in the United States. Since 1963, at least 119 bald eagles have been reported to have died as a result of lead poisoning in the United States, including Washington and Alaska which border British Columbia (1).

In the late winter of 1989, three female bald eagles were found to have elevated lead tissue levels in British Columbia.

Case 1

A mature female bald eagle was found in February 1989, at Ladysmith, British Columbia. It was extremely depressed, hypothermic, and dyspneic. The feces were bright green and watery. Radiographs revealed the presence of two lead pellets in the proventriculus and stomach (Figure 1). The bird died within 24 hours of presentation. A postmortem examination revealed green staining of the mucosa around the lead pellets, swelling of the liver, and pale streaking of the myocardium. The gall bladder was distended with dark green bile. Analysis for heavy metals revealed levels of lead in the liver and kidney of 50 mg/kg and 12 mg/kg wet weight (w/w), respectively.

Case 2

In March 1989, a mature female bald eagle was found recumbent on a road in Duncan, British Columbia. The bird was emaciated, dyspneic, and hypothermic, and died shortly after presentation. On postmortem examination, there were multiple pale foci scattered throughout the left ventricular myocardium; histologically, these consisted of large areas of myopathy and replacement fibrosis. Within focal areas there were also accumulations of heterophils mixed with fibroblasts. Numerous cardiac myofibers were fragmented and disrupted. Intrahepatic biliary stasis was noted in sections of the liver. Analysis for heavy metals in the liver revealed a lead level of 31 mg/kg w/w.

Can Vet J 1991; 32: 108–109

Island Veterinary Hospital, 1621 Townsite Road, Nanaimo, British Columbia V9S 1N3 (Langelier, Marchetti); Gulf Islands Veterinary Clinic, Box 1071, Ganges, British Columbia V0S 1E0 (Andress, Wooldridge); Duncan Animal Hospital, #5 - 471 Trans Canada Highway, Duncan, British Columbia V9L 3R7 (Grey); Animal Health Centre, Box 100, Abbotsford, British Columbia V2S 4N8 (Lewis).

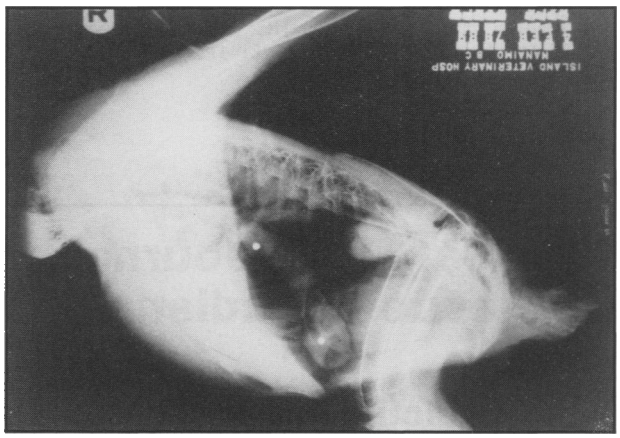

Figure 1. Lateral radiograph of bald eagle (Case 1) with a lead pellet in the proventriculus and another present in the stomach. Only 15% of lead-poisoned eagles have lead shot present in their stomachs.

Case 3

In March 1989, an immature female bald eagle died within minutes of capture on Saltspring Island, British Columbia. The bird was in good condition and, with the exception of the heart, all organs appeared grossly normal. There was epicardial mottling which did not extend into the myocardium. Histological sections revealed irregular areas of myopathy with replacement fibrosis. Intrahepatic biliary stasis was noted in the congested liver. One relatively large focus of malacia was present within the optic stria of the brain. Hemosiderin-laden macrophages were found within this area. The level of lead in the liver was 5 mg/kg w/w.

Compared to the knowledge on lead poisoning in waterfowl (1), little is known about this condition in bald eagles. Raptors have a simpler ventriculus than do waterfowl, with a more acidic pH (2), which results in a more rapid dissolution of lead pellets. One study found that 70% of the eagle "castings" examined in the mid-west contained at least one lead pellet (3). In another study, 10% of castings collected in Minnesota contained lead pellets (4), whereas another researcher noted lead pellets in 9–20% of castings examined in the same area from 1978 to 1983 (5). In a study in Missouri, lead pellets were found in 113 of 1,206 castings from bald eagles at Swan Lake (6). The lack of records of lead toxicity in bald eagles in Canada probably represents lack of surveillance rather than the absence of disease.

Only 15% of lead-poisoned eagles have lead shot present in their stomachs (4), and, as a result, lead toxicity cannot be ruled out radiographically. The clinical signs of lead poisoning are not specific and other conditions, such as cardiac disease or inanition, are often discovered on postmortem examination. Unless evaluation of levels of lead in the blood, liver, kidney, or bone is made, the diagnosis of lead toxicosis may be missed.

Experimental dosing of five bald eagles with 10 to 156 lead shot resulted in mortality of all birds in 10 to 133 days, with a loss in body weight of 16–23% (7). Lead concentrations above 5.0 mg/kg w/w in the kidney and above 10 ppm w/w in liver were suggested as indicators of acute exposure to lead (7). The sublethal effects of lead were not evaluated.

Of 17 lead-poisoned bald eagles found in 1985 and examined at the United States National Wildlife Health Laboratory, abnormalities in the hearts were found in all but one bird. Of the abnormalities, nine had myocardial infarcts, four had myocardial fibrosis, two had loss of myofibers, and 14 had degenerative arteritis (some birds had more than one type of lesion in the heart) (1). Another study found that 75% of 67 lead-poisoned ducks, geese, and swans which died of lead poisoning suffered myocardial infarctions (8). Lesions in these birds were associated with fibrinoid necrosis of the media of arterioles and small arteries.

A ban on the use of lead shot for waterfowl hunting throughout North America is necessary to eliminate this source of toxicity for bald eagles

In areas with high concentrations of waterfowl, ducks and geese are often the primary food source for eagles. This is especially true during winter when dead and crippled waterfowl are available as a result of hunting. Studies have shown that an average of 19% of ducks and 15% of geese (depending on the species, location, and time of year) are crippled when shot with lead shot. Other studies showed that approximately 30% of healthy ducks carry lead pellets (varying from 1.4% in oldsquaw to 47% in Canada geese) in their flesh (1). These healthy birds are those hit with pellets but not crippled, or crippled birds that may have recovered from injuries. This results in a large population of crippled/unretrieved ducks and healthy ducks as reservoirs of lead pellets available to predators and scavengers. The large seasonal ranges of eagles complicate identification of areas that serve as the source of lead in the death of eagles (1). The high incidence of lead poisoning in bald eagles in the United States has resulted in action to bring about a complete ban on the use of lead shot for hunting waterfowl in the United States by 1991.

Although adult female bald eagles account for approximately 25% of the population, 47% of bald eagles reported to have died of lead poisoning have been adult females. Most deaths occur in late winter or early spring, just prior to or during the breeding season (1). This represents a considerable loss of reproductive potential for this species, since a breeding age female has already overcome strong selective pressures in order to live to maturity. Normal survival rates for bald eagles are estimated to be 21.5% to 50% for the first year of life, with less than 10% survival to adulthood at five years of age (9). Loss of adult bald eagles has a more serious impact on their population than disruption of nesting efforts (10). Wildlife management efforts should be directed to increasing survival of eagles, especially adults, already in the population.

In 1990, the Canadian Wildlife Service and British Columbia Ministry of Environment will be instituting a ban on the use of lead shot in four wildlife management areas. Two of the three eagles described in this report originated from outside these areas in which lead shot is to be banned. With the large seasonal ranges of bald eagles, the potential for waterfowl to carry lead pellets throughout their flyways, and the susceptibility of eagles to lead poisoning, a ban on the use of lead shot for waterfowl hunting throughout North America is necessary to eliminate this source of toxicity for bald eagles. Further studies are needed to determine the incidence of lead pellet ingestion by bald eagles in Canada. CVJ

References

1. U.S. Fish and Wildlife Service. Final Supplemental Environmental Impact Statement on the Use of Lead Shot for Hunting Migratory Birds in the United States. Publication no. FES 86-16. Washington, DC: U.S. Fish and Wildlife Service, 1986.
2. Duke GE, Jegers AA, Loff G, Evanson OA. Gastric digestion in some raptors. Comp Biochem Physiol 1975; 50A: 649–656.
3. Platt JB. Bald eagles wintering in the Utah desert. Am Birds 1976; 30: 783–788.
4. Redig PT. An investigation into the effects of lead poisoning in bald eagles and other raptors: Final Report. St. Paul, Minnesota: University of Minnesota Endang Spec Pgm Study 100A-100B, 1984.
5. Bengston FL. Studies of lead toxicity in bald eagles at the Lac qui Parle Wildlife Refuge (Dissertation). Minneapolis, Minnesota: University of Minnesota, 1984.
6. Griffin CR, Baskett TS, Sparrowe RD. Ecology of bald eagles wintering near a waterfowl concentration. Washington, DC: 182: U.S. Fish and Wildl Serv Spec Sci Rpt — Wildl No 247, 1982.
7. Pattee OH. Experimental lead-shot poisoning in bald eagles. J Wildl Mgmt 1981; 45: 806–810.
8. Karstad L. Angiopathy and cardiopathy in wild waterfowl from ingestion of lead shot. Conn Med 1971; 35: 355–360.
9. Stalmaster MV. The Bald Eagle. 1st ed. New York: Universe Books, 1987: 145–148.
10. Grier, JW. Modelling approaches to bald eagle population dynamics. Wildl Soc Bull 1980; 8: 316–322.